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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/647,985

08/26/2003

Patricia Beauregard Smith

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03/02/2009

TEXAS INSTRUMENTS INCORPORATED

P O BOX 655474, M/S 3999

DALLAS, TX 75265

EXAMINER

GOLIGHTLY, ERIC WAYNE

ART UNIT

PAPER NUMBER

1792

NOTIFICATION DATE

DELIVERY MODE

03/02/2009

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspto@ti.com

<i>Office Action Summary</i>	Application No.	Applicant(s)	
	10/647,985	SMITH ET AL.	
	Examiner	Art Unit	
	Eric Golightly	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 November 2008.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6,8-15,17,18 and 20-25 is/are pending in the application.
- 4a) Of the above claim(s) 20-23 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6,8-15,17,18 and 20-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claim(s) 1-6,8-15,17,18 and 20-25 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. The response filed 11/14/2008 is acknowledged. Claims 1-6, 8-15, 17, 18 and 20-25 are pending. Claims 20-23 are withdrawn. Claims 7, 16 and 19 are cancelled. Claims 24 and 25 are new.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicants are advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the

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examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1, 8-15, 17, 18, 24 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 6,030,891 to Tran et al. (hereinafter "Tran").

Regarding claims 1, 8-15 and 18, Tran teaches a method of cleaning a wafer (abstract), comprising: patterning a via (col. 3, lines 52 and 53) in a porous, low-k dielectric layer (col. 3, line 65 to col. 4, line 8); cleaning a polymer residue from surfaces of the patterned dielectric layer using a wet clean solvent (col. 4, lines 52 and 53); performing a non-plasma anneal on the patterned dielectric layer prior to a barrier metal deposition (col. 5, lines 20-22), wherein the anneal comprises a low pressure anneal from about one atmosphere of pressure to substantial vacuum at about 250 °C (col. 6, lines 18-22); and after an anneal duration of about 45 seconds to about 2 minutes, stopping the anneal (col. 6, lines 23-25).

Tran discloses performing the anneal in order to remove moisture, i.e., water, absorbed during wet solvent cleaning (col. 7, lines 10-12) rather than annealing in order to remove a component of the solvent itself. However, solvents typically comprise a water component. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention that the component to be removed is water. It is noted that the annealing conditions themselves (pressure and duration) in the method as per the Tran method read on the conditions of the present application. Thus, the fact that applicant has recognized another advantage which would flow naturally from following the

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suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). Here, it would have been obvious to one of ordinary skill in the art at the time of the invention to remove a volatile component of the solvent itself due, inter alia, to the similarity of reasons given for performing the anneal between the method of the Tran teaching and the method of the present application is noted. That is, Tran discloses that the anneal is meant to inhibit absorbed moisture from volatilizing during subsequent steps (col. 6, lines 8-15), while the present application discloses that the anneal is meant to inhibit absorbed components of the solvent from volatilizing during subsequent steps (abstract). Thus, the skilled artisan would find it obvious in view of Tran to remove absorbed sources of volatilizing substances, including solvent components, in order to inhibit void formation during outgassing (col. 6, lines 8-11).

Regarding claim 17, Tran discloses the method wherein the metal deposition includes a copper deposition (col. 7, lines 60-63).

Regarding claim 24, initially it is noted that care should be exercised when reciting negative limitations, as they may tend to define the invention in terms of what it is not, rather than pointing out the invention. Thus, a negative limitation can render a claim indefinite if it is an attempt to claim the invention by excluding what the inventors did not invent rather than distinctly and particularly pointing out what they did invent. In re Schechter, 205 F.2d 185, 98 USPQ 144 (CCPA 1953). Tran teaches photoresist removal, and discloses plasma stripping as a conventional technique of removal (col. 6, lines 1-8), i.e., as merely one possible removal technique. Thus, the skilled artisan

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would find it obvious that techniques that do not subject the patterned via to a powered plasma before depositing the metal layer fall within the pale of the broader Tran teaching.

Regarding claim 25, Tran discloses annealing at a temperature of about 250 °C to about 400 °C for a duration of about 45 seconds to about 2 minutes (col. 6, lines 18-23), but does not explicitly teach annealing at a temperature of about 250 °C for a duration of about 45 seconds. However, the temperature and duration of annealing are result-effective variables in that higher temperatures and longer durations are known to result in increased drying. Thus, it would have been obvious to optimize the temperature and duration of annealing in order to enhance drying. See MPEP 2144.05(II). See discussion for claim 1, wherein a "component of the solvent" (claim 1, line 7) can be water (moisture). It is noted that the phrase "duration of about 45 seconds" in line 2 of claim 25 can be broadly, but reasonable interpreted to be open-ended, i.e., including at least 45 seconds and potentially more.

6. Claims 2, 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tran (US 6,030,891) in view of US 6,554,912 to Sahbari (hereinafter "Sahbari").

Regarding claim 2, Tran does not explicitly teach the claimed dielectric layers. Sahbari teaches a method of removing polymeric material from a substrate (abstract) and discloses using a silicon dioxide dielectrics layer (col. 7, lines 46-51), which is disclosed as advantageously having a low dielectric constant (id.). It would have been obvious to one of ordinary skill in the art at the time of the invention to use a silicon-

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dioxide dielectric layer as per the Sahbari teaching in the method as per the Tran teaching due to the advantageously low dielectric constant of silicon-dioxide.

Regarding claims 5 and 6, Tran does not explicitly teach a dry clean. Sahbari discloses a dry clean prior to cleaning the residue (col. 8, lines 58-62), and further discloses that a wet clean, followed by a dry clean and a subsequent wet clean, which reads on a dry clean prior to cleaning the residue, enhances the cleaning (col. 1, lines 63-65). Sahbari discloses using a plasma including oxygen (Sahbari at col. 12, line 67). It would have been obvious to one of ordinary skill in the art at the time of the invention perform a dry clean prior to cleaning the residue as per the Sahbari teaching in the method as per the Tran teaching in order to enhance cleaning.

7. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tran (US 6,030,891) in view of US 6,417,108 to Akino et al. (hereinafter "Akino").

Tran does not explicitly teach using a wet clean solvent comprising an acid. Akino teaches a method of manufacturing a semiconductor substrate (abstract) and discloses using a wet clean solvent comprising hydrofluoric acid (col. 6, lines 30 and 31). It would have been obvious to one of ordinary skill in the art at the time of the invention to use a wet clean solvent comprising an acid as per the Akino teaching in the method as per the Tran teaching because hydrofluoric acid is known in the art and can remove silicon dioxide without removing silicon.

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8. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tran (US 6,030,891) in view of Akino (US 6,417,108) and in further view of Sahbari (US 6,554,912).

Tran and Akino do not explicitly teach using a solvent that comprises dimethyl acetamide ("DMAC"). Sahbari discloses using a solvent that comprises DMAC (col. 6, lines 33 and 34), which has an advantageous water miscibility (col. 6, lines 25 and 26). It would have been obvious to one of ordinary skill in the art at the time of the invention to use DMAC as per the Sahbari teaching in the method as per the Tran/Akino teachings due to its miscibility.

Response to Arguments

9. Applicant's arguments, see Remarks at page 10, first paragraph through page 11, second paragraph, filed 11/14/2008, with respect to the rejection(s) of claim(s) 1-6, 8-15, 17 and 18 under 35 USC 103(a) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made as presented above.

Conclusion

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric Golightly whose telephone number is (571) 270-3715. The examiner can normally be reached on Monday to Thursday, 7:30 AM to 5:00 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Kornakov can be reached on (571) 272-1303. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

EWG

/Michael Kornakov/

Supervisory Patent Examiner, Art Unit 1792